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EXAMINER	
FOTAKIS, ARISTOCRATIS	

ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/719,061	Applicant(s) KOGA ET AL.	
	Examiner ARISTOCRATIS FOTAKIS	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _04/10/2009_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1 - 4, 11 - 12 , 14 and 16_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1 - 4, 11 - 12 , 14 and 16_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 – 4, 11 – 12, 14 and 16 are rejected under 35 U.S.C. 112, second paragraph, as failing to set forth the subject matter which applicant(s) regard as their invention. Evidence that claims fail(s) to correspond in scope with that which applicant(s) regard as the invention can be found in the reply filed April 10, 2009. In that paper, applicant has stated that "*IDCT and IDST do not refer to wavelet transforms. Therefore, discrete trigonometric transformations are different from wavelet transform*", and this statement indicates that the invention is different from what is defined in the claim(s) because the claim 1 recites of "*said first inverse wavelet transformer includes a discrete cosine transformer*" in line 1 of page 3 and "*said second inverse wavelet transformer includes a discrete sine transformer*" in line 8 of page 3. Similarly for independent claims 11 and 14.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 – 4, 11 and 14 - 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandberg et al. (US 5,715,280) in view of Xie et al in view of Mandyam (US 6,940,828).

Re claim 14, Sandberg teaches of a multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient filter bank, said multicarrier transmitter (Fig. 3) comprising:; a serial-to-parallel converter for converting serial data as said symbol mapped series of information to parallel data (#301, Fig.3); a first wavelet transformer for performing a first transform on said parallel data (#302, Fig.3 and Col 1, Lines 25 – 30 and 47 - 62); a second wavelet transformer for performing a second transform on said parallel data (#312, Fig.3); and a modulator for performing modulation by using the output from said first wavelet transformer as an in-phase signal of complex information and the output from said transformer as an orthogonal signal of complex information (SSB modulation, Fig.3) (Col 6, Lines 34 – 67 to Col 7, lines 1 – 35, Fig.3). However, Sandberg does not specifically teach of a signal point mapping unit for performing symbol mapping of a series of information and the first and second transformers include a discrete cosine transformer and a discrete sine transformer respectively performing an inverse wavelet transformation including a first and second plurality of real coefficient wavelet filters respectively.

Mandyam teaches of an OFDM transmitter that discloses of two separate discrete trigonometric transformers, an inverse discrete cosine transformer and an inverse discrete sine transformer (#46-1 and #46-2, Fig.3) for transforming data in an

OFDM communication system. However, Mandyam does not disclose of a signal point mapping unit for performing symbol mapping of a series of information and the discrete cosine transformer and discrete sine transformer respectively performing an inverse wavelet transformation including a first and second plurality of real coefficient wavelet filters respectively.

Xie teaches of a combined DMT/DWMT system for DSL application. The transmitter comprises of a serial to parallel converter (buffer and encoder, Fig.5), a wavelet transformer and a lowpass filter. Xie teaches of a signal point mapping unit for performing symbol mapping of a series of information (QAM, Page 188, Paragraph 1, Col 2) and the inverse wavelet transformer includes a plurality of real coefficient wavelet filters (equation 4) including a prototype filter including a polyphase filter (Page 188).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used trigonometric transformers (IDST and IDCT), a IDCT for outputting the in-phase signal and a IDST for outputting the quadrature signal to improve communication performance under ISI conditions. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a symbol mapper to include the I and Q components to be processed in the receiver. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the discrete cosine transformer and discrete sine transformer as taught by Sandberg and Mandyam to include a plurality of real coefficient wavelet filters to improve the orthogonality of the signal and immunity to narrow-band interference.

Re claim 16, Sandberg teaches of a multicarrier communications apparatus comprising the multicarrier transmitter according to claim 14 and a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver (Figs.2 and 3) comprising: a multiplier for downconverting a received bandpass signal to a baseband signal (Abstract, Fig.2); a local oscillator for providing said multiplier with a signal of a predetermined frequency (demodulation, Col 5, Lines 8 – 18); a LPF for removing an unwanted signal outside the band of baseband signal output from said multiplier (#202, 212, Fig.2); a wavelet transformer for performing a wavelet transform on an output signal from each said LPF (#221, Fig.2 and #342, Fig.3 and Col 1, Lines 25 – 30 and 47 - 62); an equalizer for equalizing each parallel signal of an in-phase signal output and an orthogonal signal output from said transformer as a complex signal of each subcarrier (#124, Fig.1); a parallel-to-serial converter for converting an equalized parallel signal output from said equalizer to serial data (#126, *the parallel signal from the equalized FFT would have to be serialized for the decoder to decode the signal*); determination unit for determining serial data output from said parallel-to-serial converter (#128, Fig.1, Col 4, Lines 25 – 67). However, Sandberg does not specifically teach of a first and second wavelet transformer (instead of one transformer) including a discrete cosine transformer and a discrete sine transformer respectively performing a wavelet transformation including a plurality of real coefficient wavelet filters.

Mandyam teaches of an OFDM receiver that discloses of two separate discrete trigonometric transformers, a discrete cosine transformer and a discrete sine

transformer (#82-1 and #82-2, Fig.3) for transforming data in an OFDM communication system. However, Mandyam does not disclose of the discrete cosine transformer and discrete sine transformer respectively performing a wavelet transformation including a first and second plurality of real coefficient wavelet filters respectively.

Xie teaches of a combined DMT/DWMT system for DSL application. The receiver comprises of a lowpass filter, a first wavelet transformer, an equalizer (post-detection and pre-detection equalizer, Fig.5), a parallel to serial converter and a determination unit (decoder and b(RT) bit buffer, Fig.5). Xie teaches of the wavelet transformer including a plurality of real coefficient wavelet filters (equation 4).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used any trigonometric transformer (DST or DCT), a DCT for outputting the in-phase signal and a DST for outputting the quadrature signal to improve communication performance under ISI conditions. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used to have used discrete wavelet transform of Xie on the discrete cosine transformer and a discrete sine transformer as taught by Sandberg and Mandyam that would include a plurality of real coefficient wavelet filters to improve the orthogonality of the signal and immunity to narrow-band interference.

Re claim 11, Sandberg, Mandyam and Xie teach of a multicarrier communications apparatus performing data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank including M real

coefficient wavelet filters (M being a positive integer), said multicarrier communications apparatus comprising: a multicarrier transmitter and multicarrier receiver, said transmitter comprising: a signal point mapping unit for converting bit data to symbol data to map said symbol data on M/2 complex coordinate planes; a serial-to-parallel converter for converting serial data as said mapped symbol data to parallel data; a first inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer outputting an in-phase signal of said complex data; a second inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said second inverse wavelet transformer outputting an orthogonal signal of said complex data; a SSB modulator for performing SSB modulation (Col 6, Lines 55 – 57) by using the in-phase signal of said complex data from said first inverse wavelet transformer and the orthogonal signal of said complex data from said second inverse wavelet transformer; wherein said first inverse wavelet transformer includes: a discrete cosine transformer for inputting the parallel data; and said M real coefficient wavelet filters of said first inverse wavelet transformer comprise a first prototype filter including a polyphase filter, said first prototype filter receiving output data of said discrete cosine transformer and outputting in-phase signal of complex information, and wherein said second inverse transformer includes: a discrete sine transformer for inputting the parallel data; and said M real coefficient wavelet filters of said second inverse wavelet transformer comprise a second prototype filter including a polyphase filter, said second prototype filter receiving output data of said discrete sine transformer and outputting orthogonal signal of complex information,

and wherein said multicarrier receiver includes a detector that comprises: a multiplier for downconverting a received bandpass signal as a receive signal of a received bandpass signal to a baseband signal; a local oscillator for providing said multiplier with a signal of a predetermined frequency; a LPF for removing an unwanted signal outside the band of a baseband signal output from said multiplier; a first wavelet transformer comprising M real coefficient wavelet filters orthogonal to each other, said first wavelet transformer inputting the output data from said LPF (as discussed above in claims 14 – 16).

However, Sandberg does not specifically teach of a complex data decomposer for inputting said parallel data as well as decomposing complex data into a real part and an imaginary part so as to supply an in-phase component of complex information to the (2n-1)th input to said first and said second inverse wavelet transformers and supply an orthogonal component to the 2nth input (where $1<n<(M/2-1)$), a subcarrier number is 0 to M-1) and a complex data generator for generating complex data by using the (2n-1)th output from said first wavelet transformer as an in-phase component of complex information and 2nth output as an orthogonal component (where $1 <n<(M/2-1)$), a subcarrier number is 0 to M-1).

Xie teaches of a complex data decomposer for inputting said parallel data as well as decomposing complex data into a real part and an imaginary part so as to supply an in-phase component of complex information to the (2n-1)th (n is k, Page 188, Col 2) input to inverse wavelet transformer and supply an orthogonal component to the 2nth input (where $1<n<(M/2-1)$) (Page 188, Col 2), a subcarrier number is 0 to M-1) and a complex data generator for generating complex data by using the (2n-1)th output from

said first wavelet transformer as an in-phase component of complex information and 2nth output as an orthogonal component (where 1 <n<(M/2-1)), a subcarrier number is 0 to M-1) (Figs 3 – 5, Pages 188 – 189). However, Xie does not disclose of a first and second transformers including a discrete cosine transformer and a discrete sine transformer.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the inverse wavelet and wavelet transformer configuration of Xie including the data decomposing and composing to introduce immunity to narrowband interference without adding complexity to the system.

Re claim 1, Sandberg, Xie and Mandyam teach of a multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient wavelet filter bank, said multicarrier transmitter comprises: a signal point mapping unit for performing symbol mapping of a series of information; a serial-to-parallel converter for converting serial data as said symbol mapped series of information to parallel data; a first inverse wavelet transformer including a plurality of real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer performing a first inverse wavelet transform on said parallel data; a second inverse wavelet transformer including: a second plurality of real coefficient wavelet filters that implement a Hilbert transform relative to the first plurality of real coefficient wavelet filters of said first inverse wavelet transformer (Sandberg, *Hilbert transform*, Col 6, Lines 61 – 64), said second inverse wavelet transformer performing a second inverse wavelet

transform on said parallel data and outputting an orthogonal signal of said complex data; a modulator for performing SSB modulation (SSB, Col 6, Lines 55 – 58, reference or Sandberg) by using said in-phase signal from said first inverse wavelet transformer and said orthogonal signal from the second inverse wavelet transformer, wherein: said first inverse wavelet transformer includes a discrete cosine transformer for inputting the parallel data from said serial-to-parallel converter; and said first plurality of real coefficient wavelet filters includes a first prototype filter including a polyphase filter, said first prototype filter receiving output data of said discrete cosine transformer and outputting said in-phase signal of complex information, and wherein: said second inverse wavelet transformer includes a discrete sine transformer for inputting the parallel data from said serial-to-parallel converter; and said second plurality of real coefficient wavelet filters includes a second prototype filter including a polyphase filter, said second prototype filter receiving output data of said discrete sine transformer and outputting said orthogonal signal of complex information. (Please see rejection of claim 14).

Re claims 2 – 4, Sandberg, Xie and Mandyam teach all the limitations of claim 1 as well as Sandberg teaching the inverse wavelet transformers in the transmitter (Fig.3). However, Sandberg does not teach of the configuration of an inverse wavelet transformer.

Xie teaches of a combined DMT/DWMT system for DSL application. The transmitter comprises of a serial to parallel converter (buffer and encoder, Fig.5), a

wavelet transformer and a lowpass filter. The inverse wavelet transformer comprises of a high-speed discrete cosine transformer (FFT, Fig.3) for inputting parallel data from the serial-to-parallel converter (parallel data as shown in Fig.3); a first prototype filter including a polyphase filter having a real coefficient ($p_0(n)$, Page 188, Col 2), said first prototype filter inputting output data of said high-speed discrete cosine transformer (Fig.3); M upsamplers for inputting output data of said first prototype filter (Fig.3); and M-1 single sample delay elements for inputting output data of said upsamplers (Fig.3, Z^{-1}).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the inverse wavelet transformer configuration of Xie to introduce immunity to narrowband interference without adding complexity to the system.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sandberg and Xie in view of Smart et al (US 2002/0041637).

Sandberg and Xie teach all the limitations of claim 11, as well as Sandberg further teaching of the multicarrier communications transmitter comprising of a synchronization data generator for generating a signal as data known to said multicarrier receiver and the multicarrier transmitter as a modulator for inputting said signal as known data from said synchronization data generator (symbol generator, transmitter Clock #107 and receiver clock #133, Col 4, Lines 10 – 20). However,

Sandberg and Xie do not specifically teach of the multicarrier receiver comprising: the detector for outputting adjacent complex subcarrier data including a subcarrier pair and a synchronization estimation circuit for estimating symbol synchronization timing from the difference between said adjacent complex subcarrier data items.

Smart teaches of a multicarrier receiver (Fig.15) comprising: the detector for outputting adjacent complex subcarrier data including a subcarrier pair (Paragraph 0028) and a synchronization estimation circuit for estimating a symbol synchronization timing from the difference between said adjacent complex subcarrier data items (*sliding window receiver*, Paragraphs 0196 – 0197 and 0223).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a sliding window system to provide good orthogonality between adjacent subcarriers for improving the bandwidth efficiency of the communication system.

Response to Arguments

Applicant's arguments filed April 10, 2009 have been fully considered but they are not persuasive.

Applicants submit that Mandyam fails to teach or suggest the subject matter of the present claims wherein the same parallel data from the S/P converter is input to both the IDCT and the IDST, with the in-phase and orthogonal signals being respectively output by the IDCT and IDST.

Examiner submits that Madyam teaches of N-1 parallel modulated symbols (a) where a first group of the modulated symbols are applied to a N/2-point IDCT and a second group of the modulated symbols are applied to a N/2-point IDST. The outputs 64-1 and 64-2 are orthogonal to each other and added by adder 94 to form the complex signal x(k).

Applicants submit that IDCT and IDST do not refer to wavelet transforms. Therefore, discrete trigonometric transformations are different from wavelet transform.

Examiner submits that the claims require the inverse wavelet transformer to include a discrete cosine transformer or a discrete sine transformer. The claims fail to set forth the subject matter which applicant(s) regard as their invention because the arguments that were filed are opposite of what it is claimed.

Applicants submit that Madyam does not teach of wavelet transform.

Examiner submits that Sandberg teaches of a frequency to time domain transforms which can be carried out using fast algorithms based on the **FFT**, fast **DCT** (*non-FFT*) or the equivalent. Although the Hilbert transform would output the orthogonal signal, the Examiner has brought the reference of Madyam that teaches both DCT and DST. The reference of Xie was brought to teach the use of wavelets and filter bank in a frequency to time domain transformation.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aristocratis Fotakis whose telephone number is (571) 270-1206. The examiner can normally be reached on Monday - Thursday 6:30 - 4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aristocratis Fotakis/

Examiner, Art Unit 2611

/Chieh M Fan/

Supervisory Patent Examiner, Art Unit 2611